

KELISIA AND STENOCRANUS SPECIES (HEMIPTERA: FULGOROMORPHA: DELPHACIDAE): NEW HOST-PLANT ASSOCIATIONS AND DISTRIBUTIONAL RECORDS OF EIGHT SEDGE-FEEDING PLANTHOPPERS

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Abstract.—Host-plant associations are poorly known for North American planthoppers of the genera *Kelisia* and *Stenocranus*, whose respective subfamilies – Kelisiinae and Stenocraninae – are considered sister taxa. We report sedges (Cyperaceae) as hosts of the delphacids *K. flava* Beamer, *K. parvicurvata* Beamer, *K. spinosa* Beamer, *K. torquata* Beamer, *K. vesiculata* Beamer, *S. brunneus* Beamer, *S. lautus* Van Duzee, and *S. unipunctatus* Provancher. Collections from the southern Appalachians (North Carolina, South Carolina, and Tennessee) and upper Piedmont (South Carolina) are the first southeastern U.S. records for all of the planthopper species except *K. flava*, *K. parvicurvata*, and *S. lautus*. *Stenocranus lautus* was collected from *Cyperus* spp., but the other seven delphacids were associated with diverse *Carex* spp. representing six sections of the genus. Hosts were generally common, widely distributed sedges. *Stenocranus brunneus*, however, was found on *C. austrocaroliniana* and *C. radfordii*, plant species of limited distribution and special concern. Taxonomic notes on the eight species are provided, as are morphological illustrations and notes on the habitats or communities in which they were found.

Key Words: Auchenorrhyncha, Fulgoroidea, Cyperaceae, *Carex*, *Cyperus*

Kelisia Fieber, a mainly Holarctic genus of the delphacid subfamily Kelisiinae, comprises 45 species, 12 of which occur in North America (Beamer 1945, 1951a). European species of the genus feed mostly on sedges (Cyperaceae), especially *Carex* species (Wilson et al. 1994, Holzinger et al. 2003, Nickel 2003). Specific host associations for the 12 North American species of *Kelisia* (Beamer 1951a) are unknown (Wilson et al. 1994) except for *K. flava* Beamer, which has been collected on *Scirpus cyperinus* (L.) Kunth, a sedge (Denno 1978).

Stenocranus Fieber, belonging to the closely related Stenocraninae (Dijkstra et al. 2003, Bartlett 2006), includes about 66 species, mostly Laurasian in distribution (Metcalf 1943, Calvert and Wilson 1986, Chen and Liang 2005, Bartlett 2006), although it is apparently not monophyletic (Asche and Remane 1982, Asche 1985). In the New World, *Stenocranus* consists of 16 species (Metcalf 1943; Beamer 1946a, b), one of which is not North American, *S. maculipes* (Berg, 1879) from Argentina, plus one species, *S. luteivitta* Walker, 1851, that is *incertae sedis* (Beamer 1946a). In

Europe, *Stenocranus* species feed on grasses (Poaceae) and sedges (Holzinger et al. 2003, Nickel 2003). Of the 14 North American species of *Stenocranus* (Beamer 1946a, b), hosts are known only for *S. arundineus* Metcalf and *S. similis* Crawford, which feed on grasses of the genus *Arundinaria* (*S. similis* also has been found on *Eleocharis quadrangulata* (Michaux) Roem. and Schult. by CRB), and *S. lautus* Van Duzee, which develops on *Carex lurida* Wahl., a sedge (Calvert and Wilson 1986). *Stenocranus lautus* is the only North American species of the two genera whose nymphs have been reported from a specific host.

Here, we provide new host-plant and distributional records of eight delphacids: *Kelisia flava* Beamer, *K. parvicurvata* Beamer, *K. spinosa* Beamer, *K. torquata* Beamer, *K. vesiculata* Beamer, *Stenocranus brunneus* Beamer, *S. lautus* Van Duzee, and *S. unipunctatus* Provancher. For all eight species, we briefly describe the communities or habitats from which they were collected and provide biological and taxonomic notes.

METHODS

Sedges were sampled (by AGW) mainly in the southern Appalachians of North and South Carolina, and the upper Piedmont of South Carolina. The only Tennessee records were from Roan Mountain, whose north-facing slope is in Carter County, Tennessee, and south-facing slope is in Mitchell County, North Carolina; collections from this locality are listed under a combined state header, and both states are indicated on the specimen labels. We tried to sample only pure colonies of *Carex* or *Cyperus* species. Plants were shaken or tapped over a white enamel pan and the dislodged delphacids handpicked from the pan with a shell vial. Adults were sent for identification to CRB, whose collection contains the voucher specimens. The presence of nymphs was noted, and late

instars were collected periodically and preserved in ethanol or mounted on points. Hosts are mentioned under "Host plants and habitats" and are not listed under "Material examined" except when a delphacid was found on more than one host at a particular site. In the latter section, "b" denotes brachypterous and "m" macropterous adults; asterisks indicate new state records. All photographs are from specimens taken during this study, except that of *Stenocranus acutus*. Photographs and measurements were taken by CRB using a Nikon SMZ-1500 Digital Imaging Workstation with Nikon DS-U1 digital Camera and Eclipse Net Imaging software (version 1.16.6). Scale bars on all figures represent 0.5 mm.

Kelisia Fieber, 1866

The North American Kelisiinae consist only of the genus *Kelisia*. All 12 described North American species of *Kelisia* were treated by Beamer (1945, 1951a), who described 11 of these species. Beamer's (1951a) key used color features that are generally, but not completely, reliable; male genitalia should be used to confirm species identifications. *Kelisia* individuals are often flightless, with the forewings stenopterous and longer than the abdomen, and the hindwings greatly reduced; individuals are seldom collected, except directly from the host.

Kelisia flava Beamer, 1951 (Fig. 1)

Beamer (1951a) described *K. flava* from a large series (>300 specimens) collected in Connecticut, New Hampshire, New York, North Carolina, and Pennsylvania. This species was later recorded from Maryland (Denno 1978), and Ontario, Canada (Maw et al. 2000), and specimens from Delaware are in the University of Delaware collection. Thirty-four adults were collected from the sedge *Scirpus cyperinus* in Maryland (Denno 1978).

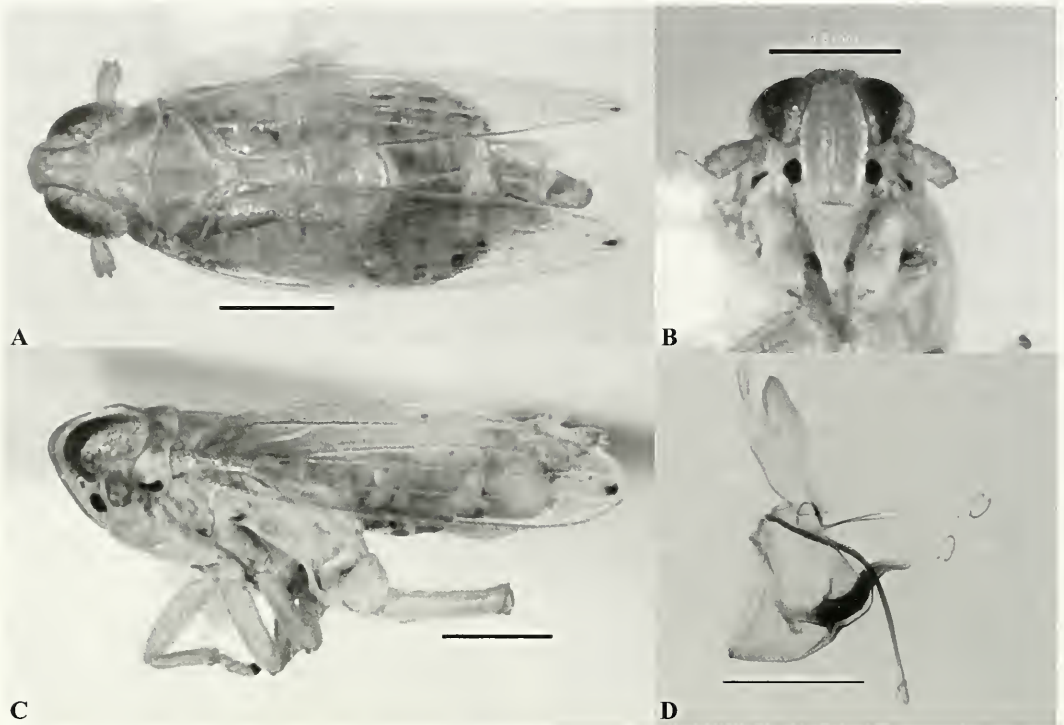


Fig. 1. *Kelisia flava* (NC: Alleghany Co.). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

Host plants and habitats.—*Kelisia flava* was collected from wetlands of the southern Appalachians. Nymphs and adults were found on *Carex bullata* Schkuhr ex Willd. at the edge of ponds in a northern subtype (Schafale and Weakley 1990) of a southern Appalachian bog (Alleghany Co., NC) and on *C. lurida* in a marshy area adjacent to a bog of Schafale and Weakley's (1990) southern subtype (Jackson Co., NC).

Taxonomic notes.—This species is most easily recognized by color, which Beamer (1951a) described as "light stamineous without fumose color anywhere (p. 120)"; however, the specimens we observed from Alleghany Co., NC, uniformly had a dark maculation below the eyes, on the lateral margins of the pronotum, and often on the mesopleuron and apex of the tegmina (Fig. 1A, C). Specimens from Jackson Co., NC (and Delaware), lacked these

maculations. All other *Kelisia* have more extensive dark markings on their wings and body. The male genitalia of *K. flava* are most similar to those of *K. axialis* Van Duzee, *K. flagellata* Beamer, and *K. spinosa* in having a pair of elongate hairlike processes arising from the link between the bases of the aedeagus and the anal segment (the presence of processes in this location is a feature of the subfamily; Asche 1990, but see Bartlett 2006). Aside from color, these species differ in the structural details of these processes, the aedeagus, and the pygofer. Most notably, *K. flava* lacks the pygofer spine of *K. spinosa*, and has a pair of dorsal subapical aedeagal teeth instead of the lateral teeth of *K. axialis* and *K. flagellata*.

Material examined.—NORTH CAROLINA: Alleghany Co., ca. 2 km WSW of Cherry Lane, 36°26.53'N, 81°01.86'W, 31 July 2004, 5 b ♂, 1 m ♀; 7–8 Aug.

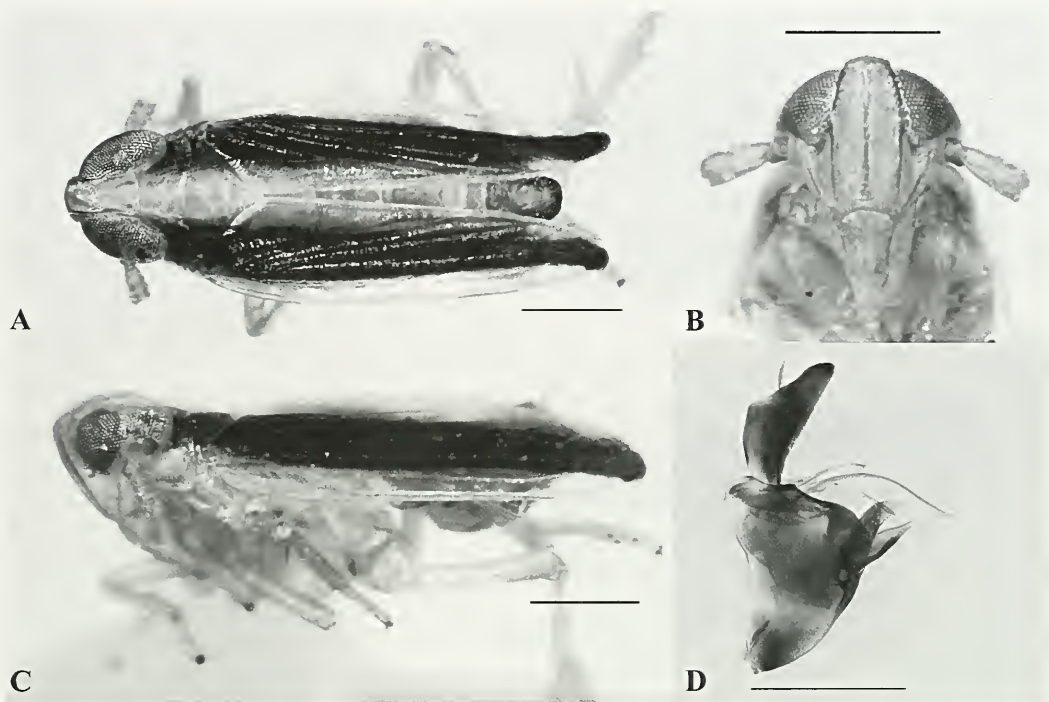


Fig. 2. *Kelisia parvicurvata* (SC: Pickens Co.). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

2004, 12 b ♂, 1 m ♀. Alleghany Co., ca. 4.5 km NE of Cherry Lane, 36°28.87'N, 80°58.73'W, 7–8 Aug. 2004, 10 b ♂, 3 b ♀; 15 Aug. 2004, 7 b ♂, 2 b ♀. Jackson Co., marshy area, Bull Pen Rd. nr. Bull Pen Bog, 35°01.94'N, 83°03.76'W, 4 Sept. 2004, 3 b ♂, 1 b ♀.

Kelisia parvicurvata Beamer, 1951
(Fig. 2)

Beamer (1951a) described this species from 9 brachypterous specimens collected at Palatka, Florida. This species was later reported from Newfoundland, Canada (Maw et al. 2000).

Host plants and habitats.—Adults and nymphs were found on *Carex lurida* growing along Eastatoe Creek in the Piedmont of South Carolina.

Taxonomic notes.—In color pattern, this species resembles *K. spinosa*, *K. torquata*, and *K. curvata*. As noted in

Beamer's (1951a) key, the dark wing stripe is narrower in *K. parvicurvata* than in *K. spinosa* (1/3 vs 2/3 wing width); however, in our specimens the dark wing stripe in *K. parvicurvata* measures slightly more than half the wing width at midlength (*K. spinosa* measures very close to 2/3 at wing midlength). Also, the external features used to separate *K. curvata* from *K. parvicurvata* are not reliable and genitalia should be examined to identify these species. The genitalia of *K. parvicurvata* have a unique (Fig 2D), elongate lobe derived from the ventral margin of the aedeagus, which in our specimens is distally free from the aedeagus for a much greater distance than it appears in Beamer's (1951a: 119) illustration.

Material examined.—*SOUTH CAROLINA: Pickens Co., edge of Little Eastatoe Creek, 34°56.93'N, 82°51.01'W, 25 Sept. 2004, 7 b ♂, 6 b ♀.

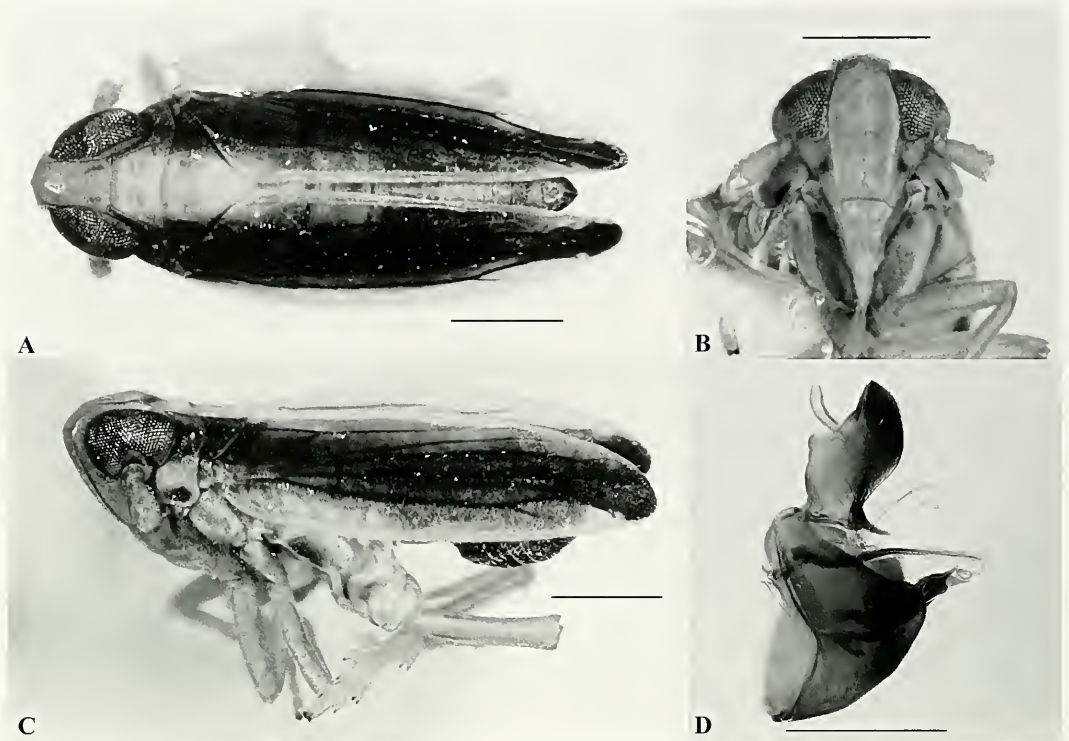


Fig. 3. *Kelisia spinosa* (Roan Mtn., TN & NC). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

Kelisia spinosa Beamer, 1945
(Fig. 3)

Beamer (1945) described *K. spinosa* from brachypterous and macropterous adults taken in the northern United States (Connecticut, Michigan, and Wisconsin) and Manitoba, Canada. All specimens in the type series were collected in August (1934, 1937). Additional state records are Pennsylvania, South Dakota (Beamer 1951a), and Illinois (Wilson and McPherson 1980); subsequent Canadian records include Ontario and Prince Edward Island (Maw et al. 2000).

Host plants and habitats.—Nymphs and adults were found on three species of *Carex*: *C. intumescens* Rudge var. *fernaldii* Bailey, *C. lucorum* Willd. ex Link var. *austrolucorum* Rettig, and *C. pensylvanica* Lam. *Carex lucorum*, once treated as

a variety of *C. pensylvanica*, now is considered a distinct species of the *C. pensylvanica* complex (Crins and Ball 1983). *Kelisia spinosa* was collected on *C. intumescens* in a heath bald near Craggy Flats (Buncombe Co., NC) and in grassy balds on *C. intumescens* and *C. pensylvanica* (Black Balsam Knob and Roan Mountain). *Carex pensylvanica* was the host on Whiteside Mountain, a high-elevation granitic dome (Jackson Co., NC); on a granitic outcrop in Alleghany County, NC; and in a *Quercus rubra*-*Acer rubrum* forest in the upper Piedmont of South Carolina (Oconee Co.). *Carex lucorum* var. *austrolucorum* was the host on a highway embankment (Transylvania Co., NC) and in a shaded area along the road to Sassafras Mountain (Pickens Co., SC). The presence on Whiteside Mountain of adults on the

grass *Deschampsia flexuosa* (L.) Trin. probably should be considered incidental (see also Discussion).

Taxonomic notes.—This is the most abundant of the *Kelisia* species observed in this study. Color features place this species as similar to *K. torquata*, *K. parvicurvata*, and *K. curvata*, although the dark longitudinal wing stripe is much broader and uniformly dark in *K. spinosa* than in these other species. This species is most clearly diagnosed by having caudally directed spines on the hind margins of the proximal portion of segment X (Fig. 3D), evidently the feature for which this species was named; *K. spinosa* also has a simple aedeagus, lacking the midventral structures of *K. torquata*, *K. parvicurvata* Beamer, and *K. curvata*.

Material examined.—*NORTH CAROLINA: Alleghany Co., granitic outcrop, ca. 7 km ENE of Laurel Springs, 36°24.4'N, 81°12.0'W, 27 Sept. 2003, 6 b ♂, 2 b ♀. Buncombe Co., nr. Craggy Flats and Blue Ridge Parkway, 14 Sept. 2003, 1 b ♂. Haywood Co., Black Balsam Knob, 35°19.4'N, 82°52.3'W, 10 Sept. 2003, 7 b ♂, 3 b ♀ (ex *C. pennsylvanica*) & 25 b ♂, 1 m ♂, 19 b ♀, 1 m ♀ (ex *C. intumescens* var. *fernaldii*); 22 Aug. 2004, 9 b ♂, 3 b ♀ (ex *C. intumescens* var. *fernaldii*). Jackson Co., Whiteside Mountain, ca. 6 km NE of Highlands, 35°04.9'N, 83°08.3'W, 21 Aug. 2002, 2 b ♂, 5 b ♀ (ex *Carex pennsylvanica*) & 1 b ♂, 3 b ♀ (ex *Deschampsia flexuosa*); 7 Sept. 2003, 7 b ♂, 8 b ♀, 1 m ♀; 22 Aug. 2004, 9 m ♂, 10 m ♀. Mitchell Co., nr. Round Bald, Roan Mountain, 36°06.6'N, 82°06.3'W, 21 Sept. 2003, 2 b ♂, 2 b ♀; Cloudland and Rhododendron Gardens, 36°06.2'N, 82°07.4'W, 21 Sept. 2003, 12 b ♂, 12 b ♀, 1 m ♀. Transylvania Co., Rt. 276, 1.4 km N of Looking Glass Falls, ca. 12 km NNW of Brevard, 35°20.3'N, 82°47.1'W, 10 Sept. 2003, 5 ♂, 8 ♀; 22 Aug. 2004, 12 m ♂, 6 m ♀. NORTH

CAROLINA (Mitchell Co.) / *TENNESSEE (Carter Co.): Carver's Gap, Roan Mountain, 36°06.4'N, 82°06.6'W, 31 Aug. 2003, 11 b ♂, 11 b ♀; 21 Sept. 2003, 5 b ♂, 8 b ♀; 27 Oct. 2002, 1 ♂, 6 ♀ (ex *Deschampsia flexuosa*). *SOUTH CAROLINA: Oconee Co., nr. East Fork Chattooga River, ca. 25 km N of Walhalla, 34°54.06'N, 83°04.31'W, 7 Sept. 2003, 2 b ♂, 2 b ♀. Pickens Co., Sassafras Mountain Rd. (S-19-199), 35°04.1'N, 82°46.9'W, 4 Oct. 2003, 5 ♂, 3 ♀; 24 July 2004, late instars only.

Kelisia torquata Beamer, 1951
(Fig. 4)

Described from Storrs, Connecticut (Beamer 1951a), *K. torquata* previously was known only from the type locality. Beamer's (1951a) description was based on brachypters (6 ♂, 16 ♀) and macropters (1 ♂, 1 ♀) collected in August 1946.

Host plants and habitats.—Adults were collected from *Carex stricta* Lam. in Sparta Bog, a northern subtype (Schafale and Weakley 2004) of a southern Appalachian bog. The nymphs collected with adults might have been those of *K. torquata*, the co-occurring *K. vesiculata* (see below), or both species.

Taxonomic notes.—This species was represented by fewer specimens than the other *Kelisia* species observed in our study. Useful color recognition features include the unmarked head and the weak longitudinal band on the wings, although this species is more strongly marked than *K. vesiculata*. The characteristic genitalia have the basal pair of processes stout and, from caudal view, lyre-shaped, and the aedeagus with a series of ventral fingerlike processes approximately at midlength (Fig. 4D).

Material examined.—*NORTH CAROLINA: Alleghany Co., Sparta Bog, 2.8 km SW of Sparta, 36°26.53'N, 81°01.86'W, 28 Sept. 2003, 2 b ♂, 1 b ♀; 29 Sept. 2005, 3 b ♂, 3 b ♀.

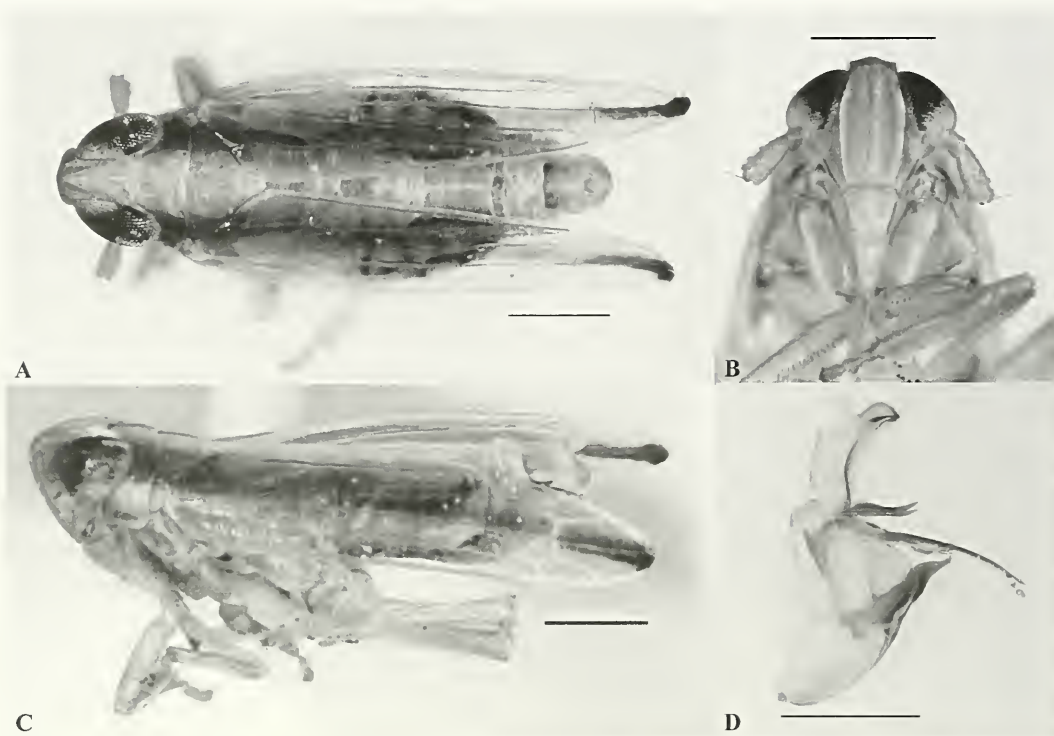


Fig. 4. *Kelisia torquata* (NC: Alleghany Co.). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

Kelisia vesiculata Beamer, 1951
(Fig. 5)

Beamer (1951a) described *B. vesiculata* from a large series collected in Storrs, Connecticut, in August 1946. It since has been reported only from Saskatchewan (Maw et al. 2000).

Host plants and habitats.—Adults were collected on *Carex stricta* in Sparta Bog and in 2003 and 2005 were syntopic with adults of *K. torquata*. In 2004, only *K. vesiculata* was found on *C. stricta* in the same area of the bog. The nymphs observed in mid-August 2004 and late September 2005 might have been those of *K. vesiculata*, *K. torquata*, or both species.

Taxonomic notes.—This species is similar to *K. flava* in being generally pale colored, except that *K. vesiculata* has dark markings on the apex of the wings (Fig 5A), lacking in *K. flava*. *Kelisia vesiculata* is most similar to *K.*

hyalina Beamer, differing externally only in that the pygofer is dark in *K. vesiculata* and pale in *K. hyalina*. The aedeagus of *K. vesiculata* is unique in having a large, ventral lobe from mid-length extending proximally nearly to the base of the aedeagus.

Material examined.—*NORTH CAROLINA: Alleghany Co., Sparta Bog, 2.8 km SW of Sparta, 36°26.53'N, 81°01.86'W, 28 Sept. 2003, 3 b ♂, 1 b ♀; 1 Aug. 2004, 7 b ♂, 3 b ♀; 15 Aug. 2004, 3 b ♂, 1 b ♀; 29 Sept. 2005, 2 b ♂.

Stenocranus Fieber, 1866

The North American *Stenocraninae* consist of the genus *Stenocranus* plus two species recently described in new genera (Bartlett 2006). North American *Stenocranus* were most recently treated by Beamer (1946a, b). The genus is evidently not monophyletic (Asche and

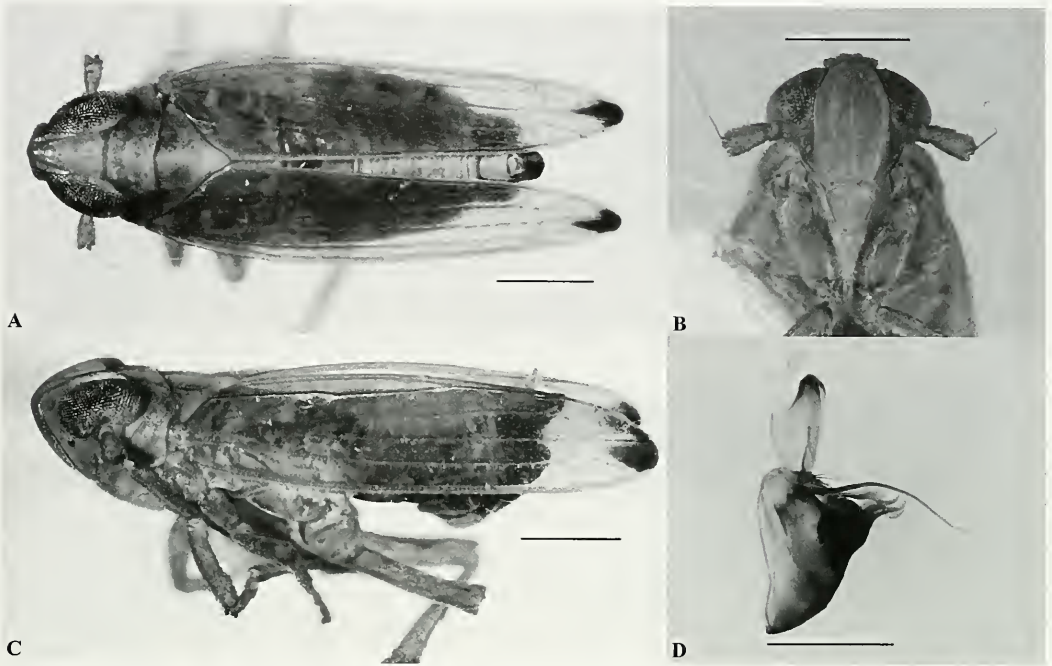


Fig. 5. *Kelisia vesticulata* (NC: Alleghany Co.). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

Remane 1982, Asche 1985) and needs revision on a world basis. Also, Beamer's (1946a) key to North American species is unsatisfactory, as it relies heavily on wing color and venation, neither of which is completely reliable in this genus, making species diagnoses difficult. *Stenocranus* individuals usually are macropterous and often are taken at lights or in general sweeping.

Stenocranus brunneus Beamer, 1946
(Figs. 6, 7A)

No new records have been published since the original description of *S. brunneus* from Illinois and Kansas by Beamer (1946a). The type specimens were collected from June to October 1930–1945 (Beamer 1946a).

Host plants and habitats.—Nymphs and adults were found on six species of *Carex*. In a cove forest in the Jocassee Gorges of South Carolina's upper Pied-

mont (Pickens Co.), the host was *C. austrocaroliniana* L.H. Bailey. Nymphs and adults were collected from three additional species of *Carex* in another cove forest at Station Cove (Oconee Co.): *C. cumberlandensis* Naczi, Kral and Bryson, *C. gracilescens* Steud., and *C. radfordii* Gaddy. *Stenocranus brunneus* also was found in the upper Piedmont of South Carolina on *C. pennsylvanica* growing among lichens and hair-cap moss (*Polytrichum commune* Hedw.) in a granitic outcrop community (Boggs Rock). In North Carolina, single adults were taken on *C. stricta* on each of two dates in Sparta Bog, and nymphs and adults were collected elsewhere in Alleghany County from *Carex intumescens* var. *fernaldii* at the edge of a pond in an area of southern Appalachian bogs. Adults, possibly incidental (see also Discussion), were found on *Cyperus strigosus* in Pickens County, South Carolina.

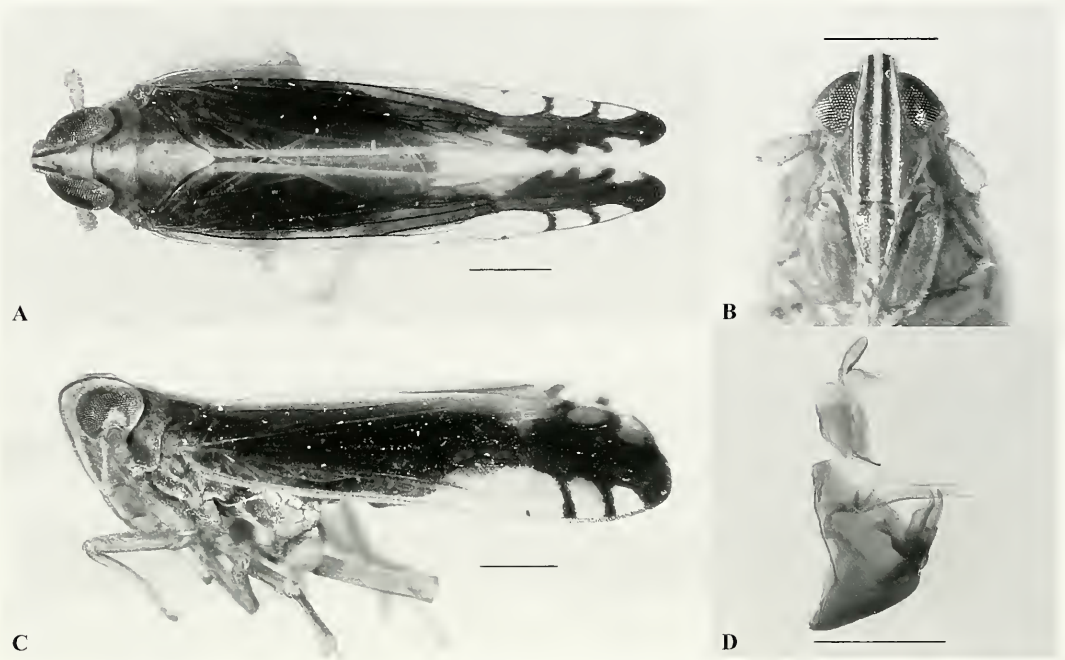


Fig. 6. *Stenocranus brunneus* (A–C, SC: Pickens Co., D, SC: Oconee Co.). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

Taxonomic notes.—This is one of four species that will key in Beamer (1946a:2) as having “ M_1 and M_2 usually stemming from R in the front wing,” which refers to a proximal fusion of these veins distal to the crossveins (see Dworakowska 1988 for modern interpretation of auchenorrhynchan wing veins). Of these four species, *S. lautus* and *S. unipuncta-*

tus are larger (>5 mm) than *S. brunneus* and *S. acutus* Beamer (<5 mm). *Stenocranus brunneus* and *S. acutus* can be difficult to distinguish, as the main external differences pertain to relative head proportions. The head of *S. acutus* is narrowed apically (noticeable in both frontal and dorsal views), and projects somewhat in front of the eyes

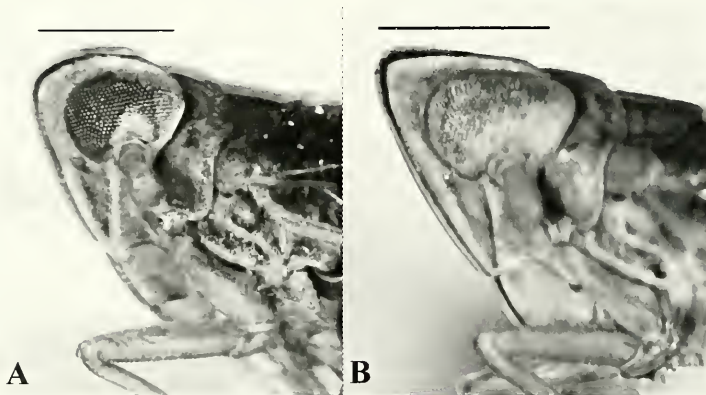


Fig. 7. Lateral view of head. A, *Stenocranus brunneus* (NC: Alleghany Co.). B, *S. acutus* (GA: Okefenokee swamp, paratype).

compared with *S. brunneus* (Fig. 7). In the specimens at hand (males only, $n=2$ for *S. acutus*), the length of the vertex along the midline is equal to or greater than 0.40 mm in *S. acutus*, less in *S. brunneus*; and the distance between the eye and anterior tip of head is 0.17 or greater in *S. acutus* and 0.14 or less in *S. brunneus*. The head of *S. acutus* also is rather acute in lateral view, versus rounded in *S. brunneus* (Fig. 7). The genitalia of these two species are similar, although the aedeagal process (ventral to curved aedeagus, Fig. 6D) is very broad up to the distal third, but only slightly broadened in *S. acutus*.

Material examined.—*NORTH CAROLINA: Alleghany Co., Sparta Bog, 2.8 km SW of Sparta, 36°26.53'N, 81°01.86'W, 1 Aug. 2004, 1 m ♂; 15 Aug. 2004, 1 b ♂; ca. 4.5 km NE of Cherry Lane, 36°28.87'N, 80°58.73'W, 7–8 Aug. 2004, 5 m ♂, 7 m ♀; 15 Aug. 2004, 4 m ♂, 4 m ♀. *SOUTH CAROLINA: Oconee Co., Station Cove, ca. 7 km WSW of Tamasee, 34°50.96'N, 83°05.11'W, 22 Sept. 2004, 1 m ♂, 5 m ♀ (ex *Carex cumberlandensis*); 25 Sept. 2004, 1 m ♀ (ex *C. cumberlandensis*), 1 m ♂ (ex *C. gracilescens*), 1 m ♀ (ex *C. radfordii*). Pickens Co., Boggs Rock, 2.1 km N of Liberty, 34°48.4'N, 82°41.6'W, 20 Sept. 2003, late instars & 4 Oct. 2003, 2 m ♂, 5 m ♀; Jocassee Gorges, Cane Creek watershed, 35°00'04.8"N, 82°52'58.7"W, 15 Sept. 2004, 2 m ♂; NE of CR-143, near Eastatooe Creek, 34°57.66'N 82°50.69'W, 25 Sept. 2005, 3 m ♂, 5 m ♀ (ex *Cyperus strigosus*).

Stenocranus lautus Van Duzee, 1897
(Fig. 8)

Described from New York (Van Duzee 1897), *S. lautus* was recorded from the District of Columbia, Illinois, Kansas, Maryland, New Hampshire, North

Carolina, and Virginia by Beamer (1946a). More recent U.S. records are Missouri (Calvert and Wilson 1986) and Tennessee (Bartlett and Bowman 2003). In Canada, it is known from Ontario and Quebec with an uncertain record from British Columbia (Maw et al. 2000). Of the five *Kelisia* and three *Stenocranus* species we treat, *S. lautus* is the only one previously associated with a specific sedge. Calvert and Wilson (1986) reported that nymphs of this bivoltine delphacid develop on *Carex lurida* in central Missouri and described the egg and five nymphal instars.

Host plants and habitats.—Nymphs and adults were found on *Cyperus esculentus* L. in a weedy area of the South Carolina Botanical Garden. Also in the Piedmont of Pickens County, SC, adults were collected from *C. strigosus* L. in a disturbed area along a path in a forested area near Eastatooe Creek. An adult was taken on *Carex cumberlandensis* at Station Cove (Oconee Co., SC) and another on *C. lurida* growing at the edge of a pond in a southern Appalachian bog in Alleghany County, NC.

Taxonomic notes.—This is the most commonly encountered eastern *Stenocranus*, although relatively few specimens were found in our study. *Stenocranus lautus* is most similar to *S. unipunctatus*, and both are larger than *S. acutus* and *S. brunneus*. The key feature of the basal fusion of the R and M veins beyond the crossveins is not consistent for either species, and the “subcosta usually with a black spot” (Beamer 1946a:2) also appears to be inconsistent (see Figs. 8C, 9C). The most consistent features are that *S. unipunctata* is smaller (4.5–5.5 mm) than *S. lautus* (5–6 mm, as reported in Beamer 1946a), and the aedeagal process is apically bifid in *S. unipunctatus*, with the two processes at right angles (Fig. 9D), versus not bifid in *S. lautus*. The latter feature is definitive for these species.

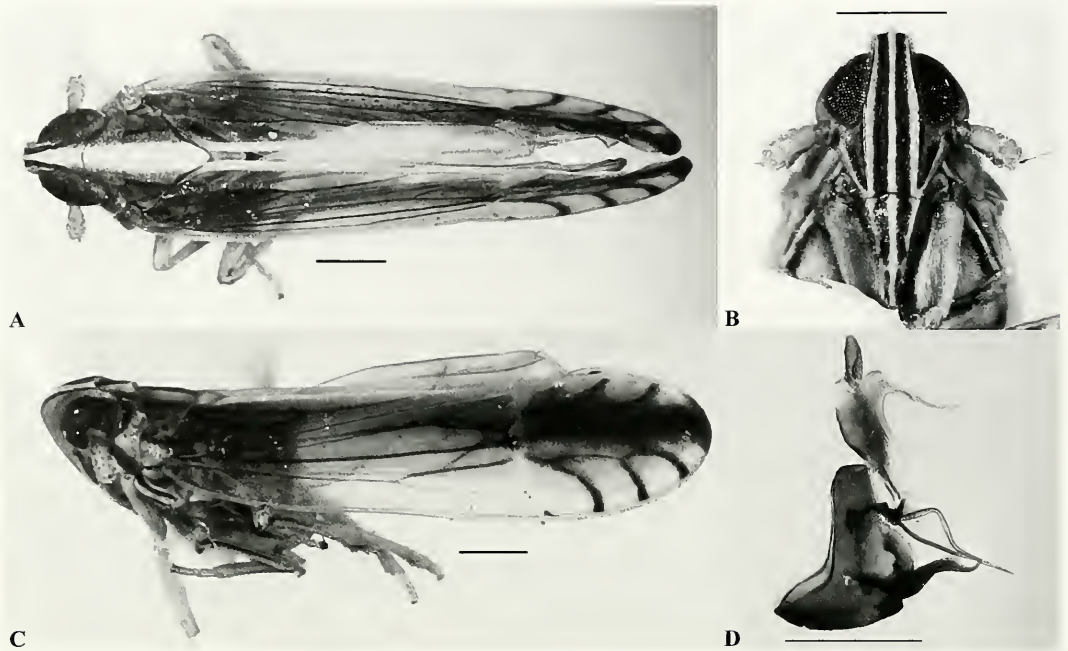


Fig. 8. *Stenocranus lautus* (SC: Pickens Co.). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

Material examined.—NORTH CAROLINA: Alleghany Co., ca. 2 km WSW of Cherry Lane, 36°26.53'N, 81°01.86'W, 7 Aug. 2004, 1 m ♂. *SOUTH CAROLINA: Oconee Co., Station Cove, ca. 7 km WSW of Tamasee, 34°50.96'N, 83°05.11'W, 25 Sept. 2004, 1 m ♂. Pickens Co., nr. Eastatoe Creek, 1.3 km N of Rt. 11, 34°57.66'N, 82°50.69'W, 25 Sept. 2004, 1 m ♂. South Carolina Botanical Garden, Clemson, 34°40.49'N, 82°49.21'W, 19 Sept. 2004, 1 m ♀; 25 Sept. 2004, 1 m ♀; 31 Oct. 2004, 1 m ♂, 1 m ♀; 31 July 2005, 2 m ♂.

Stenocranus unipunctatus
(Provancher 1872)

(Fig. 9)

Described from Quebec by Provancher (1872) (as *Delphax unipunctata*), *S. unipunctatus* was synonymized with *S. dorsalis* Fitch by Van Duzee (1912) before being resurrected as a valid species (Beamer 1946a). The only subsequent Canadian record is Ontario (Maw

et al. 2000), and the only previous U.S. record is Illinois (Wilson and McPherson 1980). Dozier (1922) noted that *S. dorsalis* is found nearly throughout the United States and Canada, but the only records assigned to this species are Maine, Illinois (Wilson and McPherson 1980), Ontario, and Quebec (Maw et al. 2000). Dozier's (1922) apparent composite concept of *S. dorsalis* likely included not only that species but also *S. unipunctatus* and other species of the genus.

Host plants and habitats.—Nymphs and adults were collected in Alleghany County, North Carolina, from *Carex intumescens* in the same southern Appalachian bog complex, northern subtype, that harbored *K. flava* and *S. brunneus*. An adult was taken on *C. stricta* in the same northern subtype bog that harbored *K. torquata* and *K. vesiculata*.

Taxonomic notes.—See comments under "Taxonomic notes" for *S. lautus*.

Material examined.—*NORTH CAROLINA: Alleghany County, ca. 4.5 km

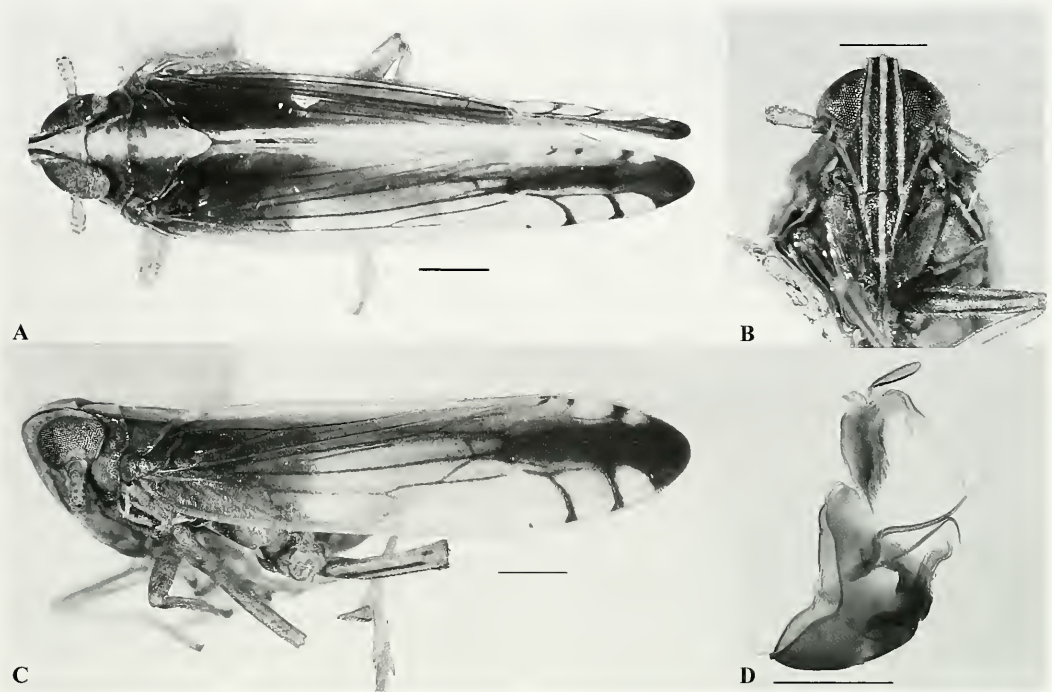


Fig. 9. *Stenocranus unipunctatus* (NC: Alleghany Co.). A, Dorsal view. B, Frons. C, Lateral view. D, Male pygofer, lateral view.

NE of Cherry Lane, 36°28.87'N, 80°58.73'W, 7–8 Aug. 2004, 2 m ♂, 6 m ♀; 15 Aug. 2004, 4 m ♂, 13 m ♀; Sparta Bog, 2.8 km SW of Sparta, 36°26.53'N, 81°01.86'W, 1 Aug. 2004, 1 m ♂.

DISCUSSION

An association with grasses and sedges has long been known for North American species of *Kelisia* and *Stenocranus* (e.g., Dozier 1922, Osborn and Drake 1922, Van Duzee 1923, Osborn 1938). Yet, in a group as host restricted as the Delphacidae (Wilson et al. 1994), the determination of specific host plants is desirable, especially in the case of the speciose sedge genus *Carex*. Delphacid-sedge relationships are incompletely known, even for the relatively well-studied European fauna. Sedges are undercollected because they often grow in bogs, fens, and other hard-to-access

communities that field biologists tend to avoid. Sedges also are difficult to identify, particularly when withered or in a vegetative condition (Nickel 2003).

For the eight species of *Kelisia* and *Stenocranus* that we treat, only one specific host association previously has been documented: *S. lautus* on *C. lurida*, a sedge (Calvert and Wilson 1986). *Scirpus cyperinus* apparently is a host of *K. flava* according to Denno (1978).

Raymond Beamer, who described six of the eight delphacids for which we give host plants (and 11 of the 12 North American *Kelisia*), was an excellent collector. Hungerford (1958:60) noted that Beamer “was untiring and enthusiastic in the field and the best collector I ever knew.” Beamer’s wife Lucy usually accompanied him in the field, and through the years they incorporated new techniques into their collecting repertoire after observing methods used

by specialists in other insect groups (L. Beamer 1946). The Beamers collected from sedges (L. Beamer 1946), and they collected nearly all of the new species he described in the mostly sedge-feeding genera *Kelisia* and *Stenocranus* (Beamer 1945, 1946a, b; 1951a). Host relationships, however, were not mentioned in his taxonomic reviews of those genera; rarely did he refer to specific grasses or sedges as delphacid hosts (e.g., Beamer 1947, 1951b).

We observed nymphs of *S. lautus* on *Cyperus esculentus* and adults on *C. strigosus*, in addition to an adult on *Carex cumberlandensis* and one on its previously recorded host, *C. lurida*. Nymphs of the other *Kelisia* and *Stenocranus* species were found only on *Carex*, with the species that served as hosts belonging to six sections of the genus (Flora of North America Editorial Committee 2002). Only in North Carolina at Bull Pen Bog and an adjacent marsh and, especially at Sparta Bog, were we uncertain about a host association—that is, unable to determine that planthoppers at those sites were restricted to *Carex stricta* and not found on syntopic sedges. Nickel (2003) alluded to the difficulty of assigning a particular hopper species to a particular host when sedges occur in mixed stands.

On Whiteside Mountain, several adults of *K. spinosa* were collected from the grass *Deschampsia flexuosa* (L.) Trin. growing about 3 m from a colony of *Carex pensylvanica* harboring nymphs and adults of the delphacid. Nymphs and adults of *S. brunneus* were found only on *Carex* species except for the adults taken on *Cyperus strigosus* in Pickens County, South Carolina. Nickel (2003) mentioned that European delphacids considered strictly monophagous on particular host grasses occasionally are found as adults, or even nymphs, on other grasses. He acknowledged that such occurrences might be more wide-

spread and may potentially enable a herbivore to avoid the constraints of specialization. The presence, however, of *K. spinosa*, whose nymphs have been observed only on sedges, likely is only incidental on the grass *D. flexuosa*. *Kelisia* nymphs were not found during a study of two delphacid species that develop on this grass (Wheeler and Bartlett 2006), nor were nymphs of *Kelisia* found on other grasses at Whiteside Mountain (AGW, personal observation). The relationship of *S. brunneus* to *C. strigosus* might also be incidental.

As is the case for most phytophagous insects (e.g., Strong et al. 1984), planthoppers are associated mainly with plants that are widespread and abundant (Nickel 2003). Host plants of the eight keliisine and stenocranine planthoppers generally were common, widely distributed sedges typically found in eastern North America from southern Canada south to at least the Carolinas (Flora of North America Editorial Committee 2002). *Cyperus esculentus* and *C. strigosus* often are weedy sedges of disturbed areas (Whitson et al. 2000, Tucker et al. 2002), and *Carex stricta*, on which three delphacid species were collected, might be the most common sedge in wetlands of eastern North America (Standley et al. 2002). We collected *Kelisia* and *Stenocranus* species on one to three hosts, except for *S. brunneus*, nymphs of which were found on six hosts, including the widely distributed *Carex gracilescens* and *C. pensylvanica*, as well as *C. austrocaroliniana*, a species of special concern known only from six states (Kentucky and Tennessee to Alabama and Georgia), and the recently described *C. cumberlandensis* (Naczi et al. 2001) and *C. radfordii* (Gaddy 1995). The latter sedge, recorded only from a few sites near the Blue Ridge escarpment in northeastern Georgia, southwestern North Carolina, and northwestern South Carolina, is a species of

conservation concern (Bryson and Naczi 2002).

Knowledge of host relationships among European kelisiine and stenocranine planthoppers is sufficiently mature to discern trends in their diet breadth (Nickel and Remane 2002; Holzinger et al. 2003; Nickel 2003). Any attempt to discuss host-plant specificity among North American kelisiines and stenocranines would be premature. Including the host plants that we report, specific hosts are known for less than one-third of the North American species of *Kelisia* and *Stenocranus* (Wilson et al. 1994). Two of the species we discuss—*K. torquata* and *S. brunneus*—had not been mentioned in the literature since their original descriptions (Beamer 1946a, 1951a). Certain European *Kelisia* species once considered rare have proved common upon discovery of their hosts (Nickel 2003), and that trend also appears to hold for most of the delphacids treated here. Even if uncommon potential hosts are discounted as being unlikely to yield Delphacidae, the sheer number of North American sedges—more than 840 species, with about 480 in *Carex* (Flora of North America Editorial Committee 2002)—will make difficult an inventorying of the Cyperaceae for kelisiines and stenocranines. Much more fieldwork is needed, not only for a better understanding of the host-plant ranges of the eight species we report, but also for discovering the hosts used by the remaining North American species of *Kelisia* and *Stenocranus*.

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